

## I-75 Modernization Traffic Noise Analysis Segment 12b

# Oakland County, Michigan

## Project Description

The I-75 roadway improvement project is located in Oakland County, Michigan. The February 2015 Noise Report represents an update the FEIS study document completed in May 2005. The present analysis addresses updates to the Michigan Department of Transportation (MDOT) traffic noise policy guidelines and impact criteria that became effective in 2011. These policy changes are outlined in the July 2011 *MDOT Highway Noise Analysis and Abatement Handbook*. In addition to the policy updates, future predicted noise levels were determined using Federal Highway Administration (FHWA) TNM 2.5 model rather than the TNM version 2.1 used during the FEIS phase. A map of the overall project study area is illustrated in Figure 1 with Segment 12b shown in the upper left hand corner. As depicted in Figure 2, Segment 12b is bounded by Squirrel Road on its eastern most extent to the terminus of the Heathers Condominium community and Golf Course on its most western point.

**Figure 1**  
**TNM Modeling Segments**

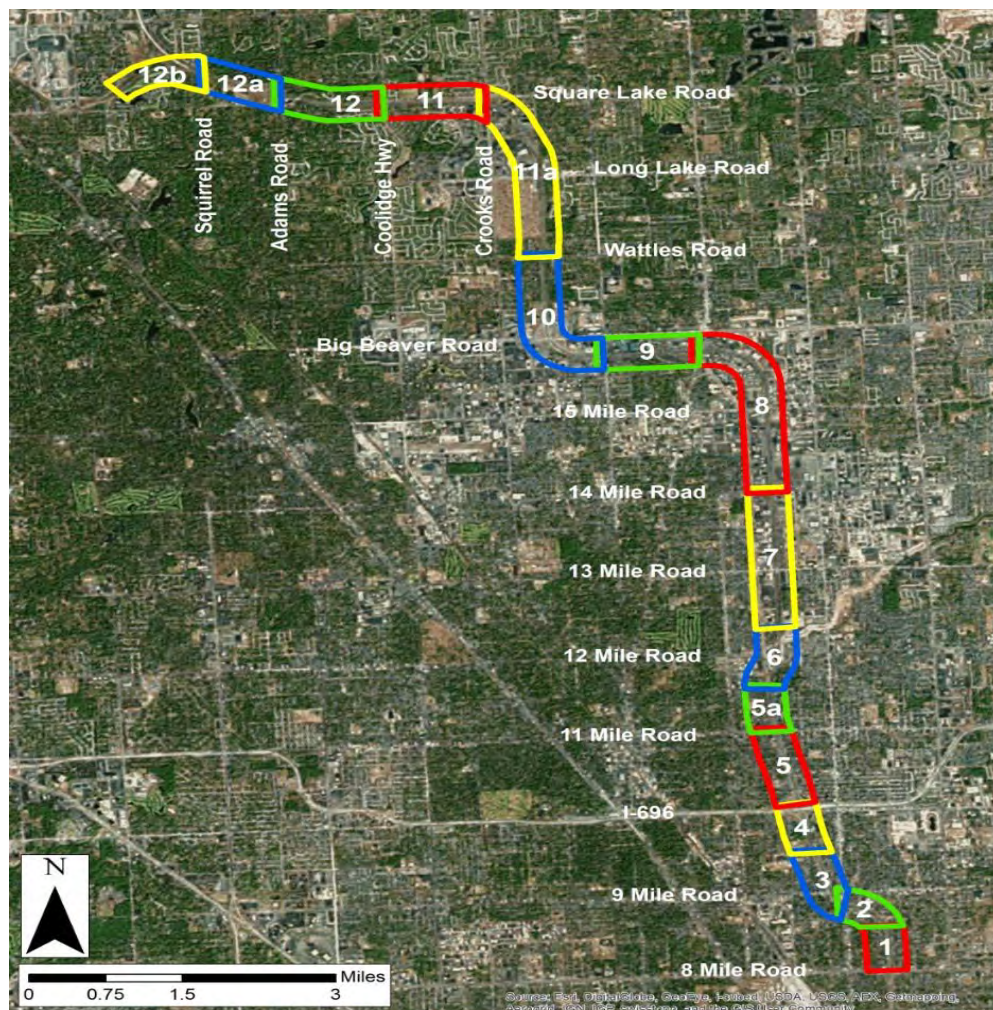


Figure 2 Segment 12b Noise Monitoring Site



## FUNDAMENTAL CONCEPTS OF ROADWAY NOISE

Sounds occur in the human and natural environment at all times. Some sounds are necessary or desirable for communication or pleasure, some are unnoticed and other sounds are unwanted, causing annoyance and disturbance to the people living or working in the area. Therefore, by definition, unwanted sound is referred to as noise. The following sections provide a background for some of the physical properties and terminology of sound and noise.

### A-Weighted Sound Level

The most commonly used measure of noise level is the A-weighted sound level (dBA). From many experiments with human listeners, scientists have found that unlike animals the human ear is more sensitive to midrange frequencies than it is to either low or very high frequencies. At the same sound level, midrange frequencies are therefore heard as louder than low or very high frequencies. This characteristic of the human ear is taken into account by adjusting or weighting the spectrum of the measured sound level for the sensitivity of human hearing range. The A-weighted sound level is a measure of sound intensity with one-third octave frequency characteristics that correspond to human subjective response to noise weighted. The A-weighted sound level is widely accepted by acousticians as a good descriptor for assessing human exposure and annoyance from environmental noise. Figure 3 illustrates some common A-weighted noise levels.

An understanding of the following relationships is helpful in providing a subjective impression of changes in the A-weighted sound level:

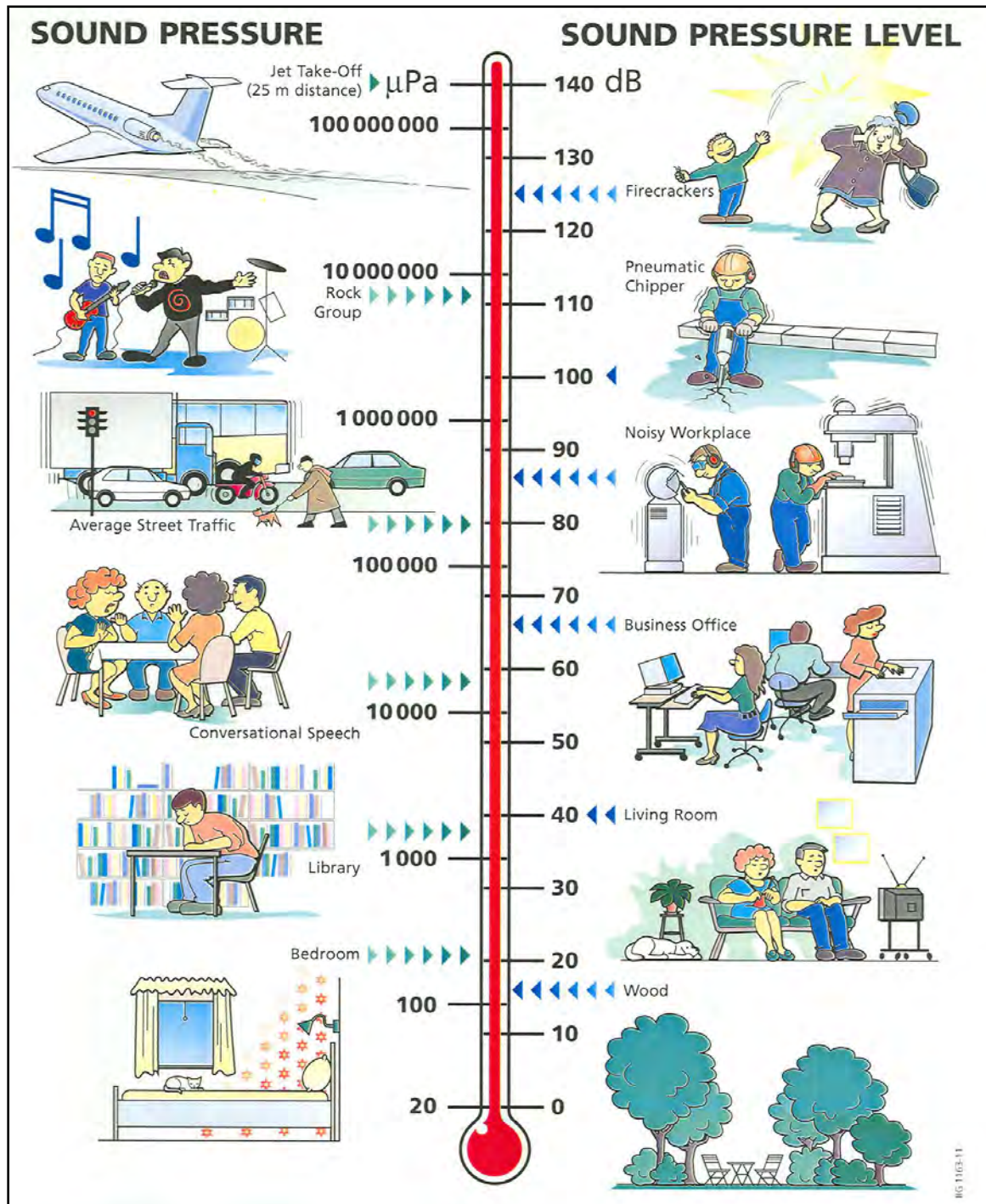
- Except in carefully controlled laboratory experiments, an increase of only 1 dB in A-weighted level cannot be perceived.
- Outside of the laboratory, a 3 dB increase in A-weighted level is considered a just-noticeable difference.
- A change in A-weighted level of at least 5 dB is required before any significant change in the noise level in a community is perceived.
- A 10 dB increase in A-weighted level is subjectively heard as approximately a doubling in loudness, independent of the existing noise level.

### Sound Level Descriptors

The third basic parameter of environmental noise is its time-varying character. The sound level from any roadway fluctuates from moment to moment as time passes. These fluctuations constitute the time-varying properties of roadway noise.

Because environmental noise fluctuations vary from moment to moment, it is common practice to condense all of the information into a single number, called the “equivalent” sound level ( $L_{eq}$ ). The  $L_{eq}$  is a measure of the average sound energy during a specified period of time (typically 1 hour duration). The  $L_{eq}$  is defined as the constant level that, over a given period of time, transmits the same amount of acoustical energy to the receiver as the actual time-varying sound. Studies have shown that  $L_{eq}$  noise descriptor is well correlated with human annoyance to sound; therefore, this descriptor is widely used for environmental noise impact assessments. The  $L_{eq}$  measured over a one-hour period is the hourly  $L_{eq}$  (1-hour), which is used to analyze highway traffic noise impacts and abatement acoustic effectiveness.

Figure 3 Typical Noise Levels



## Existing Ambient Noise Levels

Existing ambient noise levels were not measured at any location directly within the Heathers Condominium community. However, noise measurements were collected at two representative residential locations within the nearby Adams Woods community. These locations are identified as measurement sites R27 and R27A in the I-75 Modernization Traffic Noise Analysis Report and were part of the Segment 12A study area depicted in Figure 1. The location of these two monitoring sites is shown in Figure 2 and a summary of measured noise levels is presented in Table 1. Measured peak hour AM noise levels at both R27 and R27A were found to be about one decibel below the MDOT 66 dBA impact threshold. Because the Heathers Condominium Complex is located further away from the I-75 interchange traffic than monitoring sites R27 and R27A is from I-75, existing peak hour ambient noise levels in the Heathers Condominium Complex can be expected to be lower than those levels reported in Table 1.

**Table 1**  
**Summary of Amient Measured Noise Levels in Nearby Study Segment 12A**

Receptor	Location	Date	Land Use Type	Time of Reading	Measured Leq (1hr) dBA
R27	Timberview east of Meadowglen Court	5-28-14	Residential Condo	6:30 PM to 6:45 PM	65.0
R27A	Timberview Rd	5-28-14	Residential Condo	6:53 PM to 7:08 PM	64.9

## Future 2035 Build Conditions Noise Level Estimates

Segment 12b was created to model noise exposure within the Heathers Condominium complex. This area was not included in the original noise study since at that time no design changes were proposed in this area. However, since then the proposed highway design has changed. The on-ramp from Square Lake Road to I-75 South is being shifted away from the Heathers Condominiums and the northbound main line is being placed alongside the southbound mainline. The updated design also relocates the I-75 northbound exit ramp to Square Lake Road from the left side of the freeway to a traditional right-side exit. The noise modeling in this area incorporated all these new roadway design elements.

A summary of the predicted 2035 noise levels within the Heathers Condominium is provided in Table 2 and is graphically illustrated in Figure 4 by the red dots representing impacted properties and green dots representing non-impacted properties. The noise modeling of this community found two impacted receivers representing 6 equivalent receptors, of which five represent an elevated tee box on the community golf course represented by receiver GS. The noise modeling under future 2035 build traffic conditions found only one residential impact represented by receiver R12 in Table 2. Noise levels at R12

were found to just reach the 66 dBA impact threshold. Therefore, because the vast majority of residential properties, experienced no impact from the proposed highway design improvements a sound barrier was not considered.

## Conclusion

The study findings indicate that the proposed roadway improvements will result in nearly no impact to the vast majority of residences living within the Heathers Condominium complex. A single residence identified by receptor R12, as shown in Table 2, would experience peak hour noise levels just at the 66 dBA impact threshold. A sound barrier was not considered because of the lack of noise impact for this residential community under future 2035 build traffic conditions.

<b>Table 2</b> <b>Summary of Segment 12b Predicted Future Build Noise Levels</b>		
<b>Receptor ID</b>	<b>Predicted 2035 Build Noise Level Leq (1 hr) dBA</b>	<b>MDOT/FHWA Impact (YES/NO)</b>
<b>GC6</b>	<b>72.4</b>	<b>Yes</b>
GC3	63.1	No
GC2	57.0	No
GC1	51.2	No
Receiver5	50.3	No
Receiver6	48.9	No
Receiver7	50.3	No
Receiver8	50.0	No
Receiver9	54.0	No
GC5	60.6	No
<b>Receiver12</b>	<b>66.0</b>	<b>Yes</b>
Receiver13	65.1	No
Receiver14	62.5	No
Receiver15	61.1	No
Receiver16	62.4	No
Receiver17	61.5	No
Receiver18	60.7	No
Receiver19	59.8	No
Receiver20	59.4	No

<b>Table 2 (Continued)</b> <b>Summary of Segment 12b Predicted Future Build Noise Levels</b>		
<b>Receptor ID</b>	<b>Predicted 2035 Build Noise Level</b>	<b>MDOT/FHWA Impact (YES/NO)</b>
Receiver21	59.1	No
Receiver22	58.0	No
Receiver23	57.5	No
Receiver24	55.8	No
Receiver25	55.9	No
Receiver26	55.1	No
Receiver27	54.4	No
Receiver28	53.5	No
Receiver29	47.4	No
Receiver30	49.8	No
Receiver31	50.1	No
Receiver32	58.0	No
Receiver33	57.1	No
Receiver34	57.7	No
Receiver35	58.1	No
Receiver37	56.5	No
Receiver38	56.4	No
Receiver39	56.3	No
Receiver40	52.3	No
Receiver41	52.7	No
Receiver41	52.7	No
Receiver43	57.2	No

Figure 4 Segment 12b Summary of Impacted Receivers

